

SAND99-1739
Unlimited Release
Printed July 1999

Analysis of Subsidence Data for the Bryan Mound Site, Texas

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Abstract

The elevation change data measured at the Bryan Mound Strategic Petroleum Reserve (SPR) site over the last 16+ years has been studied and a model utilized to project elevation changes into the future. The subsidence rate at Bryan Mound is low in comparison with other Strategic Petroleum Reserve sites and has decreased with time due to the maintenance of higher operating pressures and the normal decrease in creep closure rate of caverns with time. However, the subsidence at the site is projected to continue. A model was developed to project subsidence values 20 years into the future; no subsidence related issues are apparent from these projections.

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Introduction

The subsidence monument elevations at the Bryan Mound Strategic Petroleum Reserve (SPR) site have been surveyed nine times beginning in December, 1982. The earlier survey data have been most recently reported on by Osnes (1995). This report provides an update which includes additional measurements completed in the past few years. The changes in elevation, the rates of subsidence, as well as projections of future elevation changes are presented. Elevation data were most recently collected at the Bryan Mound site in January 1999. Data of this type is important and has been used by the cavern engineer and other site personnel in assuring certain aspects of site integrity. A layout of the site with caverns and the DOE property boundary is given in Figure 1.

At Bryan Mound and SPR sites in general, elevation changes are measured because they document surface subsidence resulting from creep closure of caverns. General subsidence on the scale of the site or portions thereof is seen in the survey data taken. This type of subsidence will capture gross effects of creep closure of underground openings in response to the state of stress. Survey measurements are taken at the site every other year. However, the detailed long term subsidence provided by the surveys is important, especially because it permits the long term extrapolation of elevation changes into the future.

Elevation data represents the raw data. The most recent data set included 65 data points. The number of data points varies from year to year because it is a function of ability to find monuments, destruction of monuments, damage to monuments, etc. This year 24 monuments were repositioned, therefore data for the past two years has been lost at these positions, and another three monuments were destroyed; as a result a total of about a third of the possible data at Bryan Mound was lost for this measurement period. The measurements have been made at various time intervals; the current time interval was about two years.

In practice, measurements of subsidence are difficult at best. At Bryan Mound the reference is an off-site benchmark. This has the potential to introduce some small error in traversing the distance to the site. The leveling surveys are performed to Second-Order First-Class accuracy, with allowable vertical closure not to exceed approximately $0.025 \text{ ft}/\text{mile}^{0.5}$ (Osnes, 1995).

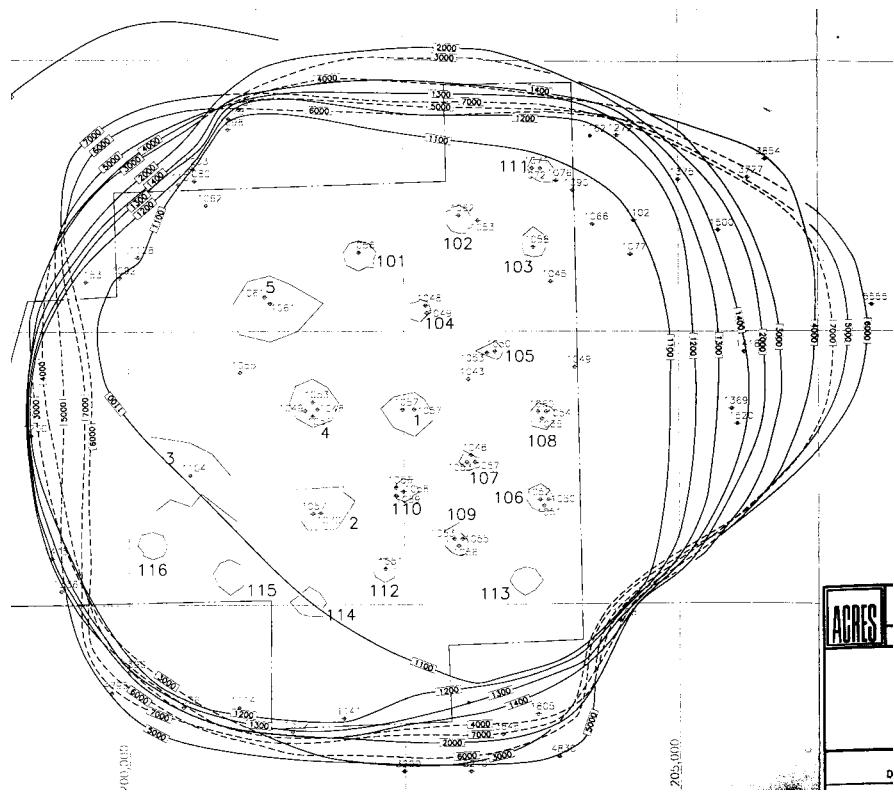


Figure 1. Top of salt rock contour map at Bryan Mound. From Neal, et al., 1994, "Strategic Petroleum Reserve (SPR) Additional Geologic Site Characterization Studies Bryan Mound Salt Dome, Texas," SAND94-2331. Also shown are cavern location and the DOE property boundary.

The Bryan Mound site is generally low in elevation and is susceptible to flooding. On the southeast are Mud Lake, the Intracoastal Waterway, and the Gulf of Mexico, on the west is the New Brazos River, and on the northwest is Blue Lake. The caprock at Bryan Mound is approximately 300 feet thick with some minor faulting. The effect of this caprock's thickness and structure is an unknown. The extensive area at or below 10 feet of elevation and the proximity to water represent important factors in studying the subsidence at this site. The historic elevation of the Bryan Mound site and evidence of the progressive subsidence at the site are shown in Figures 2, 3, and 4. Significantly, during the past 16 years the extent of the site area with an elevation less than 10 feet has nearly doubled (from 25% to near 50%).

Data, Analyses, and Results

Elevation data is reported in Appendix 1 and portrayed in Figures 2-4. Some stations are located on well heads, thus the elevations reported are for well head elevations, not the ground level. This location of stations on well heads is common for SPR sites, because of the convenience. The January, 1999 elevation data are presented in Figure 2. Elevations recently reported (Figure 2) are generally consistent with the projected continual slow subsidence of the site. Twenty-four survey points were recently repositioned (vertically) during site maintenance activities and are shown in red. As a result of the maintenance, these data cannot be used in the current analysis. Beginning with the next survey these points can be used in assessing the elevation change at these locations. Later in the report, analyses are presented which obviate the immediate need for these data. However, routine loss of this many data points from survey to survey would eventually compromise the ability to provide meaningful analyses and thus would limit the ability to make good projections of elevations into the future.

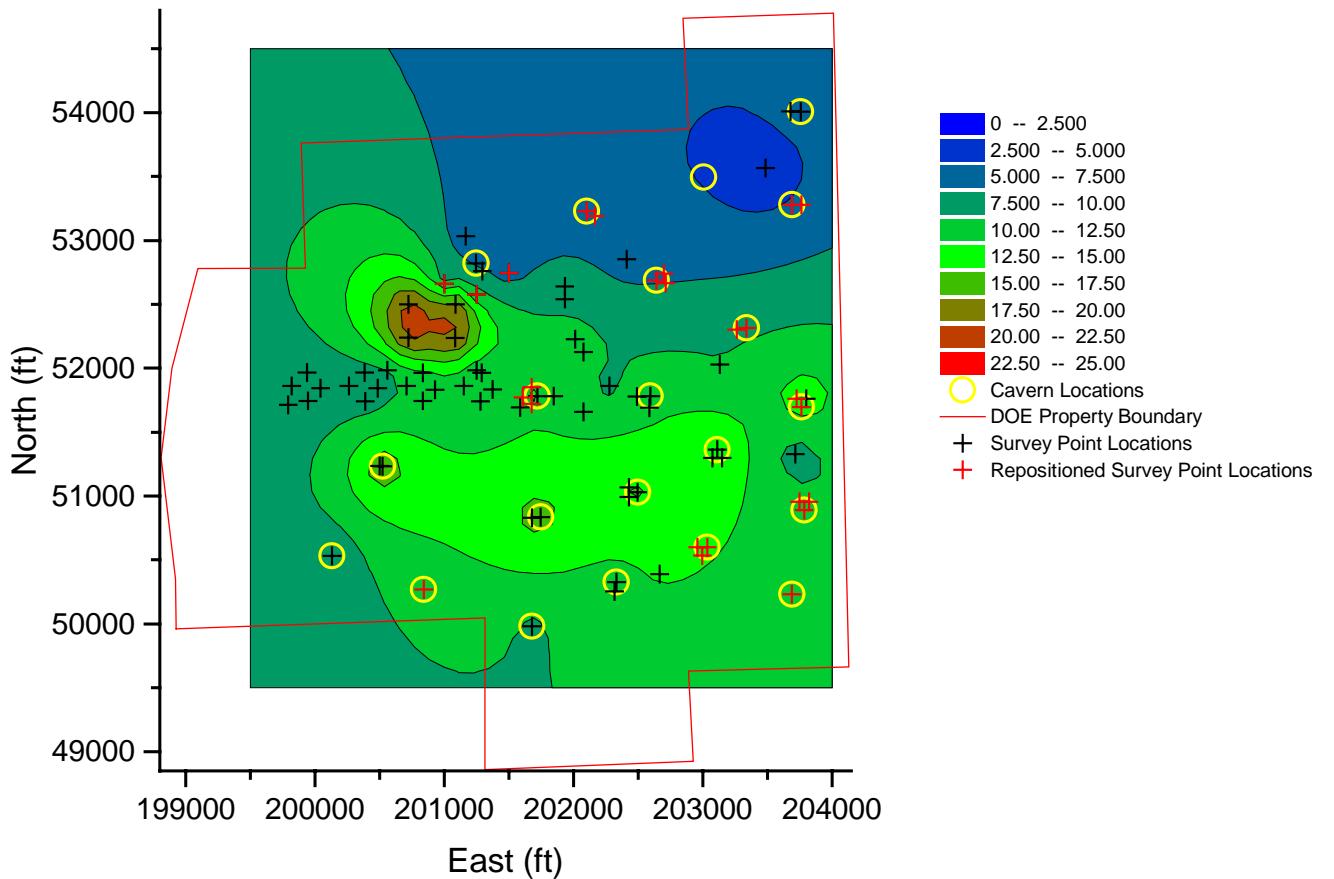


Figure 2. Bryan Mound site measured elevations (feet), January, 1999. The contour interval is 2.5 feet.

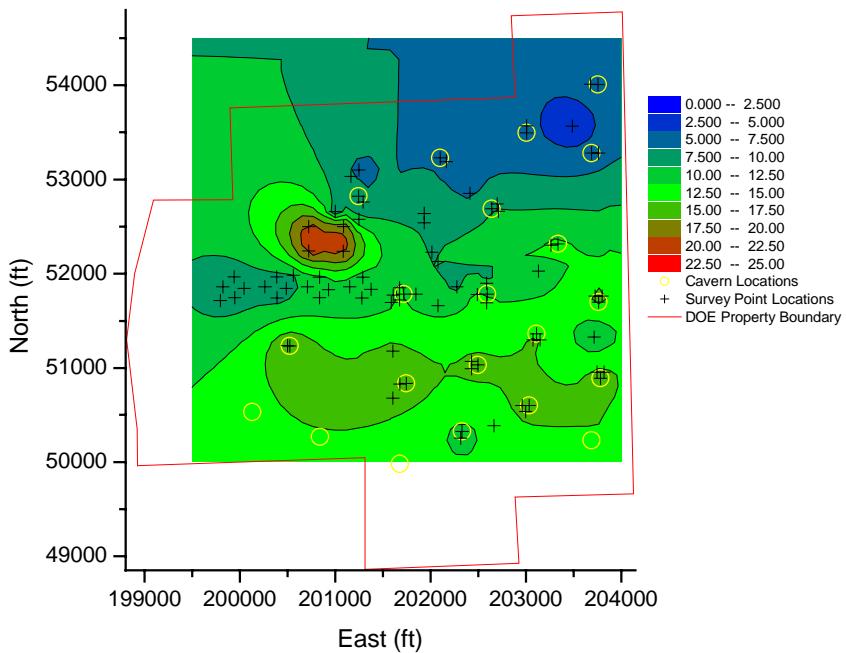


Figure 3. Bryan Mound site measured elevations (feet), February, 1991. The contour interval is 2.5 feet.

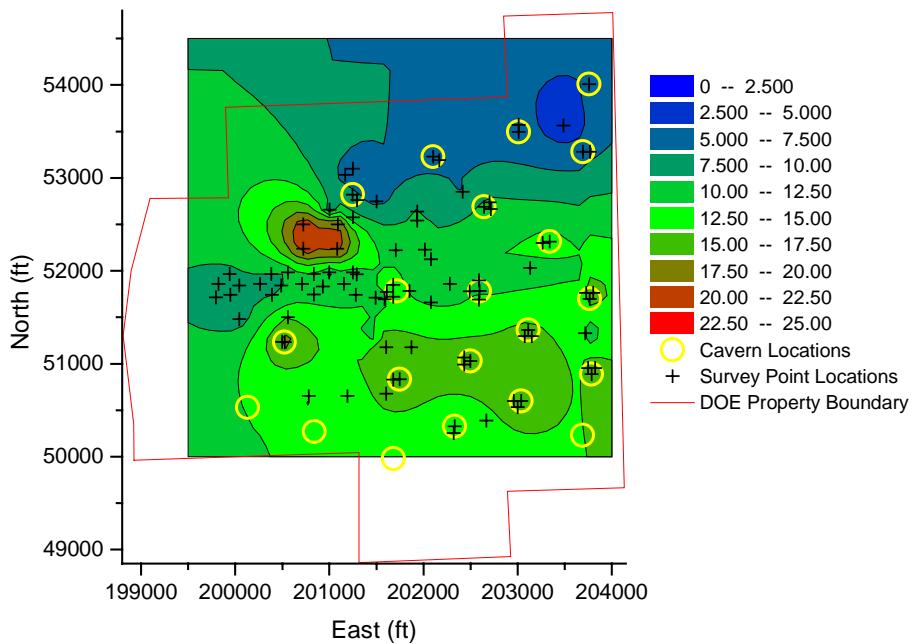


Figure 4. Bryan Mound site measured elevations (feet), December, 1982. The contour interval is 2.5 feet.

The rate of subsidence was studied to determine the uniformity of subsidence rates across the site. Local areas of greater subsidence rates may be signals of abnormal creep closure behavior of the underlying SPR caverns. The rate of subsidence is calculated by dividing the amount of elevation change in a time period by the time span of the period in years. This calculation was made for each time period between measurements and is presented in Appendix 2. The calculation was also made for longer time periods and results are presented in Figures 5, 6, and 7. The long time periods should incorporate the variation from one measurement to the next that sometimes marks variability in the subsidence rate (Appendix 2).

The rate of subsidence has decreased during the measurement period. For the first six years of measurement (1982-1988) the site subsidence rate ranged from 0.08 to 0.12 feet per year (Figure 5); for the next five years the rate decreased to 0.02 to 0.08 inches per year (Figure 6). For the most recent five year time period, the rate has decreased further and is now closer to a 0.01 to 0.05 feet per year value (Figure 7).

The decrease observed is probably due to at least two reasons, the operational procedure adopted of maintaining the caverns at relatively high operating pressure and the corresponding decrease in creep closure rate of the caverns. Transient creep effects also diminishes the closure rate with time (Ehgartner, 1992).

Some monuments at each site are on well heads, some are “deeply rooted” and some are attached to surface elements (for example light poles, buildings, etc.). All of these types of monuments are valuable to the elevation monitoring array at a site. Those monuments attached to surface elements may be effected by near surface phenomena, for example water level changes, although this effect has never been proven. Monuments that sit on well heads are tied by the casing to the top of the cavern. These monuments likely record the effect of deeply seated displacements.

In each of the time periods portrayed, the subsidence rate is slightly greater in the southern (Figure 6) and southwestern portions, (Figures 7 and 8) of the site. This appears to be a consistent trend. For the most recent two year measurement period (2/97-1/99), that greater rate area appears to centered in an area that extends from Cavern 3 (plugged and abandoned) east to Cavern 2, and northeast from Cavern 3 about 1000'. The most recent value of the subsidence rate at Cavern 3 is a little more than 0.125 feet per year. While this remains a relatively small value in comparison to other SPR sites, it does represent a statistically significant change from the previous time period, and is large compared to historical values at Bryan Mound. These measurements may be the result of error, periodic measurement variations (which have occurred in the past), or they could be “real”. However, this observation may be signaling an area at the site that should be watched more closely until the next survey (about 24 months). Both Caverns 3 and 2 are shallow (top near -1500 ft) and somewhat pancake shaped.

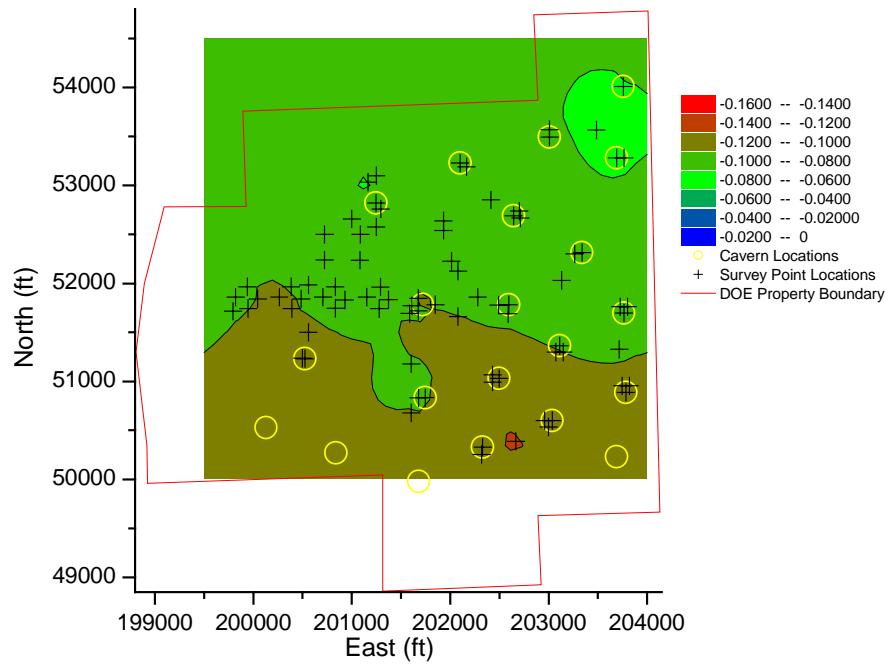


Figure 5. Bryan Mound subsidence rate, 12/82-12/88 (ft/yr). The contour interval is 0.02 ft/yr.

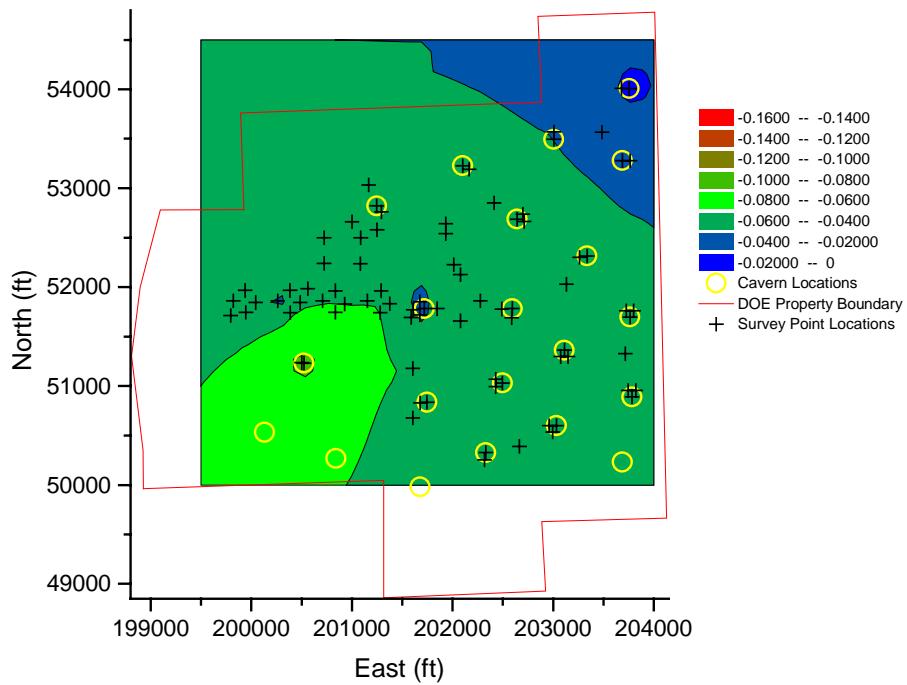


Figure 6. Bryan Mound subsidence rate, 12/88-4/94 (ft/yr). The contour interval is 0.02 ft/yr.

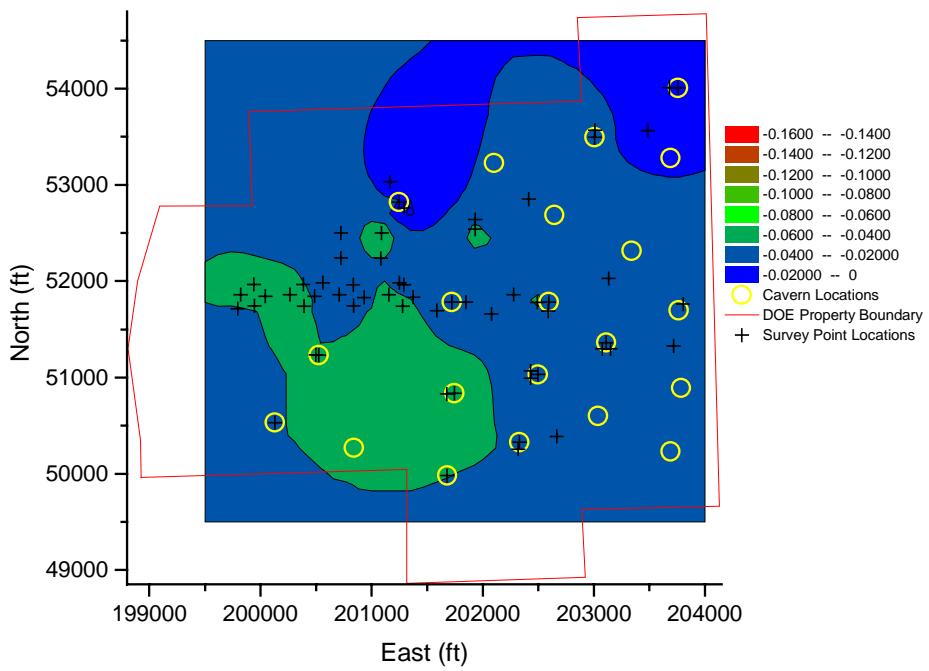


Figure 7. Bryan Mound Subsidence Rates (ft/yr), 4/94-1/99. The contour interval is 0.02 ft/yr.

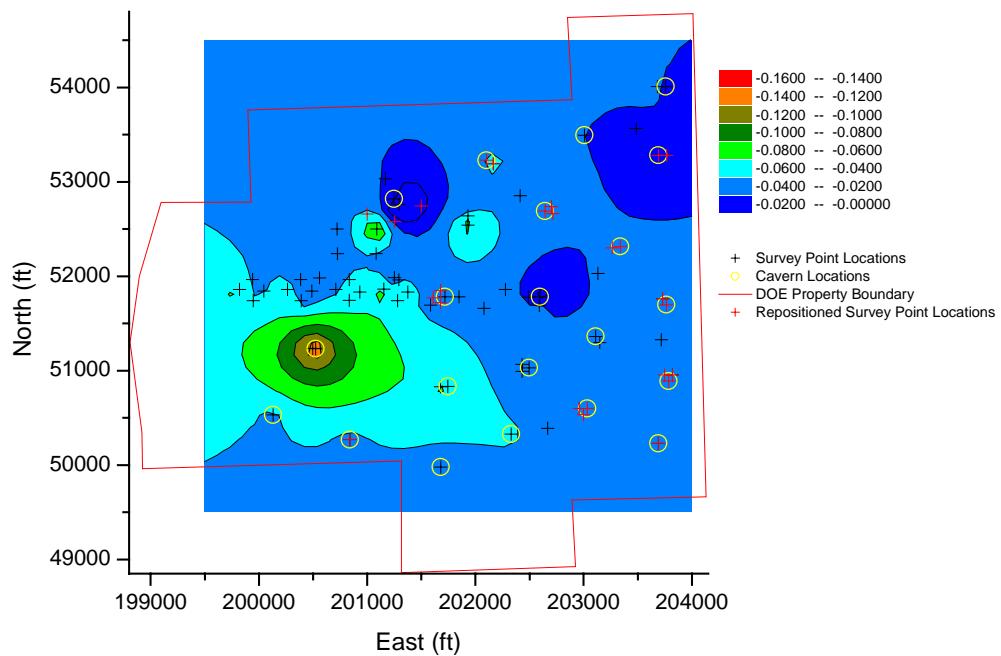


Figure 8. Bryan Mound Subsidence Rates (ft/yr), 2/97-1/99. The contour interval is 0.02 ft/yr.

It is important to develop a relationship to extrapolate changes in elevation into the future, in order to provide the DOE with important information for planning future work at the site. Such an extrapolation is possible by making use of the past history of the elevation measurements. Elevation data collected at known times at each station were fit to a first order exponential decay of the form:

$$Y = Y_o + A_1 e^{-(x-x_0)/t_1}$$

where Y is the calculated elevation at the time of interest (x), Y_o is the elevation at X_0 (time=0), A_1 is a constant, and t_1 is a fitting parameter.

This relationship allows the data to be projected into the future with confidence. Examples of the data compared to the first order exponential decay relationship are given in Figure 10. Appendix 3 contains fitting parameters for equations fit to data for each measurement station allowing the reader to make projections to any time in the future.

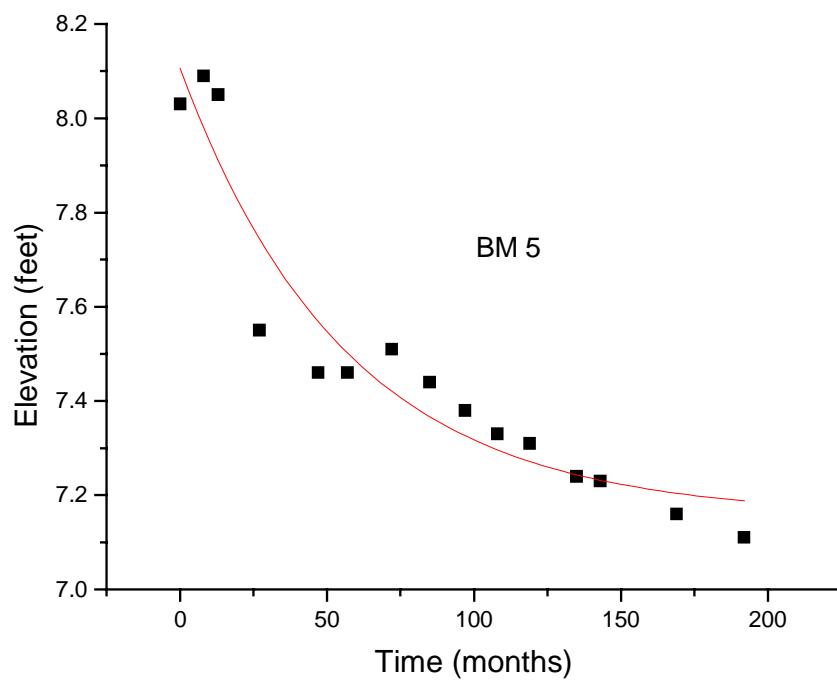
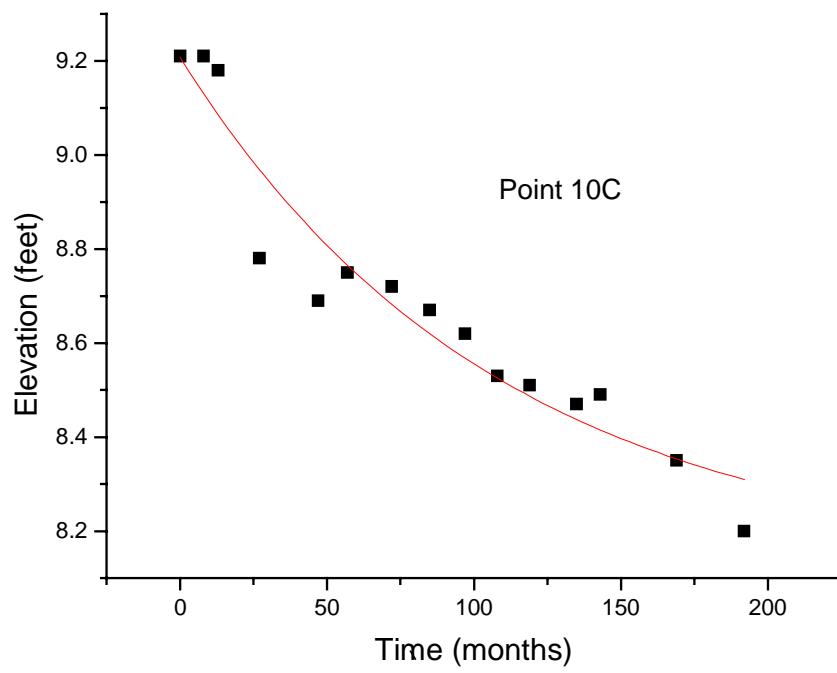


Figure 9. Examples of the exponential decay fit for stations “10C” and “BM 5”.

Projected elevations for the years 2004, 2009, and 2019 are presented in Figures 9, 10, and 11. Consistent with information already presented, it is predicted that the Bryan Mound site will continue to subside, but at an ever decreasing rate in accordance with the first order exponential decay.

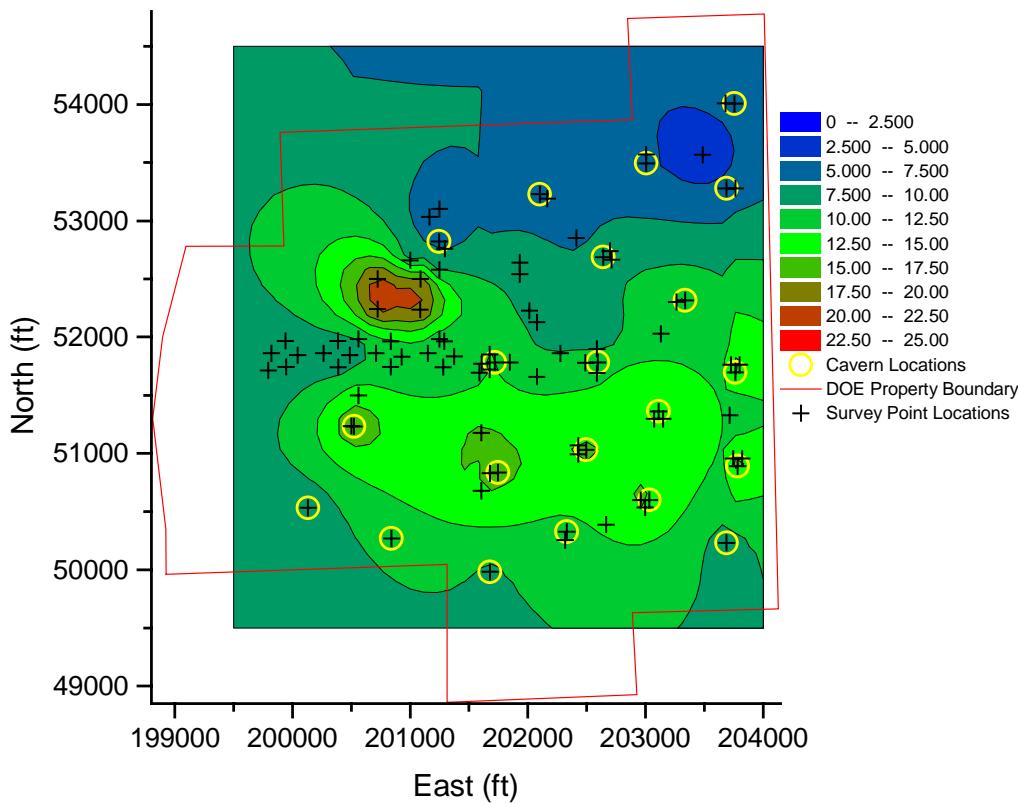


Figure 10. Bryan Mound site projected elevations (feet) for the year 2004. The contour interval is 2.5 feet.

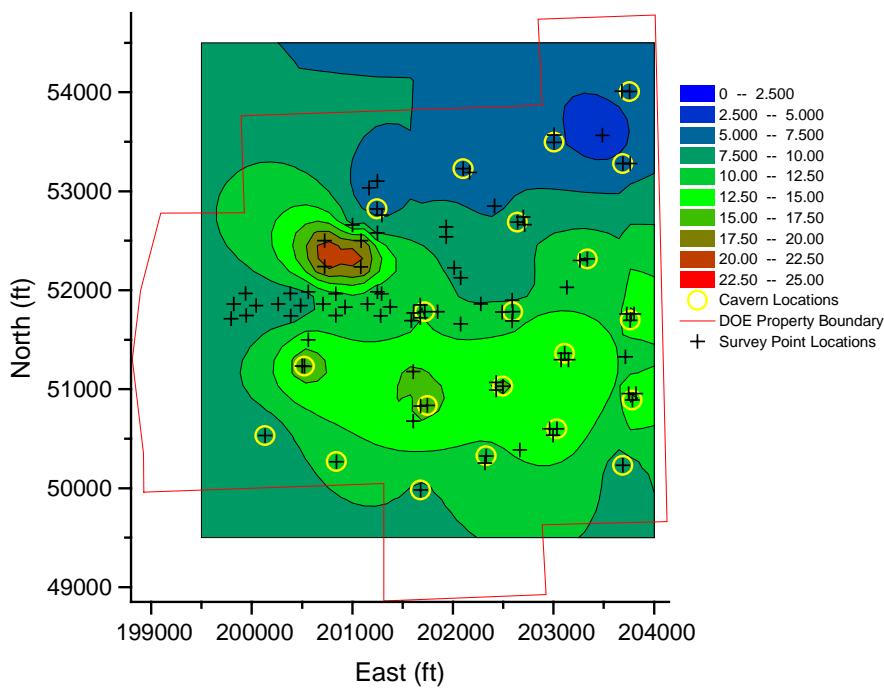


Figure 11. Bryan Mound site projected elevations (feet) for the year 2009. The contour interval is 2.5 feet.

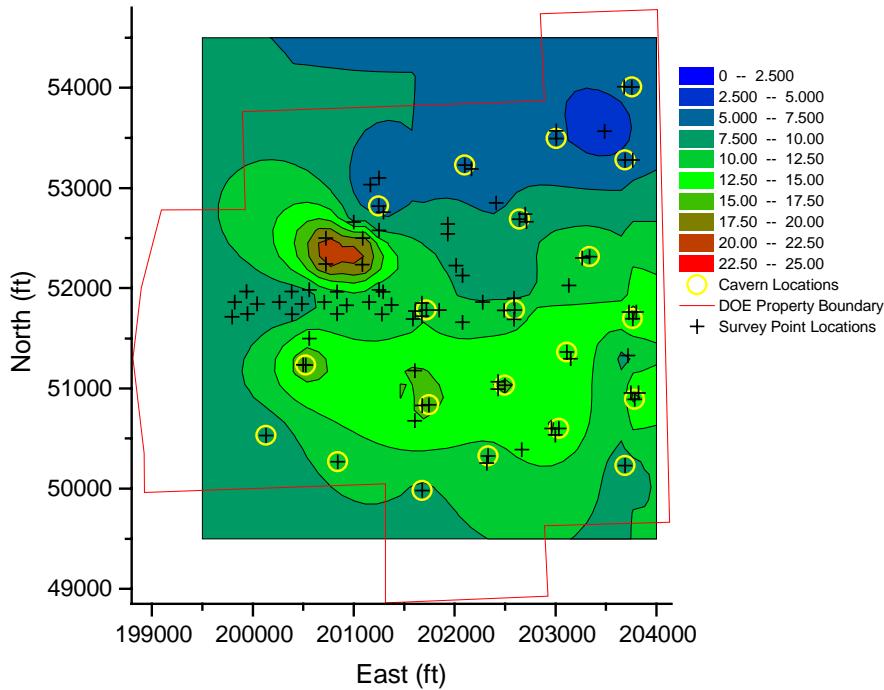


Figure 12. Bryan Mound site projected elevations (feet) for the year 2019. The contour interval is 2.5 feet.

Discussion and Conclusions

Even though Bryan Mound is historically known for its low subsidence rates, subsidence at the site continues. Moreover, the site remains vulnerable to flooding due to its low elevations.

The south and southwestern areas of the site have slightly greater subsidence rates (although the trend is for rates at the site to decrease overall).

The loss of data from 24 disturbed monuments for this measurement period is significant. These data were lost because the well heads were serviced, thus moving the measurement elevation. If meaningful and reliable analyses of site elevations are to be made, accommodations should be made during the servicing to enable new datums to be referenced back. Analyses are presented which obviate the immediate need for these data. However, routine loss of this many data points from survey to survey would eventually compromise the ability to provide meaningful analyses and thus would limit the ability to make good projections of elevations into the future.

The elevation change data at the Bryan Mound SPR site has been studied and a model utilized to project elevation changes 20 years into the future. This work may assist DOE in planning the construction and location of mitigative measures for operations. The results could also modify the details of life extension measures.

Operationally it is prudent to continue the practice of maintaining the caverns at relatively high operating pressure. The measured subsidence rate is increased for time periods when higher cavern pressures were not maintained, and decreased for time periods when relatively high cavern pressures were maintained.

The results of analyses warrant the following conclusions:

- The subsidence rate has decreased with time due to relatively high operating pressures of caverns and the decrease in creep closure of caverns with time.
- The subsidence rate at Bryan Mound is low in comparison with other SPR sites; the subsidence at the site is projected to continue, however, if the cavern pressure is maintained at current levels, the subsidence rate can be expected to decrease.
- A model was developed to project subsidence values 20 years into the future; no subsidence related issues are apparent from these projections. As stated above, the site remains vulnerable to flooding due to its low elevations.
- If future elevation measurements deviate significantly (subsidence rates greater than anticipated) from the model results, we should make every effort to determine the cause for this deviation.

References

Ehgartner, B., 1992, "Effects of Cavern Spacing and Pressure on Subsidence and Storage Losses for the U.S. Strategic Petroleum Reserve" SAND91-2575, Sandia National Laboratories, Albuquerque, NM.

Osnes, J., 1995, "Update to subsidence analyses of SPR site for fiscal years 1993 and 1994," Re/Spec Topical Report RSI-0590 for DynMcdermott, published 3/95.

Magorian, T.R. and J. T. Neal, 1988, "Strategic Petroleum Reserve (SPR) Additional Geologic Site Characterization Studies Bryan Mound Salt Dome, Texas," SAND88-2267, September, 1988, Sandia National Laboratories.

Appendix 1

Measured and Projected Elevations at Bryan Mound (feet above sea level)

POINT	NORTH	EAST	DEC 82	AUG 83	JAN 84	MAR 85	NOV 86	SEP 87	DEC 88	JAN 90	FEB 91	JAN 92	DEC 92	APR 94	DEC 94	FEB 97	JAN 99	JAN 99	2004	2009	2019
			0	8	13	27	47	57	72	85	97	108	119	135	143	169	192		calculated		
6A	51232.3	200524.7	19.64	19.64	19.63	19.11	19.00	19.00	19.00	18.93	18.86	18.61	18.55	18.53	18.63	18.62	18.34	18.45	18.38	18.34	18.31
6C	51236.6	200498.9	19.63	19.50	19.61	19.12	19.00	19.00	19.00	18.92	18.85	18.61	18.61	18.50	18.66	18.62	18.31	18.44	18.35	18.31	18.27
7A	51742.9	201279.6	11.40	11.39	11.36	10.87	10.78	10.80	10.78	10.69	10.63	10.56	10.51	10.48	10.48	10.39	10.30	10.37	10.33	10.31	10.30
7B	51861.5	201152.9	11.44	11.45	11.41	10.91	10.82	10.84	10.86	10.76	10.70	10.61	10.57	10.54	10.53	10.41	10.25	10.38	10.32	10.29	10.26
7C	51833.9	201374.7	#N/A	11.41	11.37	10.87	10.78	10.79	10.81	10.71	10.65	10.57	10.51	10.50	10.47	10.41	10.31	10.40	10.36	10.35	10.34
7D	51962.6	201290.8	11.37	11.40	11.34	10.85	10.82	10.80	10.81	10.72	10.65	10.57	10.52	10.50	10.47	10.40	10.31	10.38	10.33	10.30	10.29
8A	51746.0	200835.2	11.45	11.47	11.44	10.94	10.83	10.86	10.89	10.82	10.73	10.64	10.62	10.57	10.56	10.48	10.39	10.47	10.42	10.40	10.39
8B	51859.8	200708.8	11.36	11.35	11.32	10.82	10.84	10.84	10.88	10.83	10.74	10.66	10.62	10.58	10.57	10.49	10.42	10.49	10.44	10.42	10.40
8C	51831.8	200930.4	11.47	11.48	11.44	10.95	10.84	10.85	10.91	10.82	10.74	10.65	10.62	10.58	10.56	10.49	10.42	10.49	10.45	10.43	10.42
8D	51965.0	200834.2	11.45	11.48	11.45	10.96	10.85	10.86	10.91	10.84	10.76	10.68	10.65	10.60	10.58	10.53	10.44	10.51	10.48	10.46	10.45
9A	51742.8	200389.9	9.45	9.46	9.44	8.92	8.82	8.87	8.87	8.79	8.72	8.66	8.59	8.55	8.54	8.40	8.37	8.43	8.38	8.35	8.34
9B	51859.7	200264.6	9.36	9.34	9.31	8.81	8.80	8.85	8.63	8.78	8.71	8.65	8.60	8.55	8.53	8.41	8.26	8.41	8.36	8.33	8.32
9C	51842.7	200487.8	9.48	9.47	9.45	8.94	8.84	8.87	8.89	8.81	8.74	8.69	8.62	8.59	8.55	8.44	8.41	8.47	8.43	8.41	8.40
9D	51965.2	200384.3	9.46	9.48	9.46	8.96	8.84	8.89	8.90	8.84	8.77	8.71	8.65	8.62	8.58	8.47	8.44	8.50	8.46	8.44	8.42
10A	51743.0	199947.3	9.30	9.29	9.26	8.78	8.69	8.72	8.71	8.64	8.58	8.49	8.46	8.43	8.43	8.29	8.23	8.30	8.43	8.23	8.21
10B	51859.6	199821.1	9.21	9.21	9.18	8.78	8.69	8.75	8.72	8.67	8.62	8.53	8.51	8.47	8.49	8.35	8.20	8.32	8.25	8.21	8.17
10C	51842.6	200044.2	9.36	9.33	9.30	8.81	8.71	8.76	8.75	8.68	8.62	8.53	8.50	8.45	8.46	8.32	8.26	8.34	8.30	8.28	8.26
10D	51965.8	199939.5	9.24	9.26	9.22	8.73	8.62	8.64	8.65	8.60	8.54	8.47	8.43	8.38	8.38	8.26	8.21	8.29	8.25	8.24	8.23
11A	52237.5	201083.2	24.27	24.20	24.28	23.77	23.72	23.72	23.73	23.71	23.65	23.55	23.58	23.51	23.48	23.40	23.34	23.43	23.40	23.39	23.39
11B	52238.7	200724.1	24.54	24.48	24.55	24.06	24.02	24.01	24.03	24.00	23.95	23.86	23.88	23.84	23.80	23.73	23.68	23.76	23.74	23.73	23.73
11C	52500.1	200723.0	24.06	23.99	24.07	23.57	23.50	23.52	23.54	23.53	23.48	23.39	23.41	23.34	23.33	23.25	23.22	23.29	23.28	23.27	23.27
11D	52499.8	201088.1	24.23	24.15	24.23	23.72	23.66	23.65	23.66	23.65	23.59	23.49	23.51	23.45	23.37	23.34	23.11	23.28	23.23	23.20	23.18
12B	52541.0	201932.5	10.48	10.52	10.49	9.95	9.85	#N/A	9.90	9.85	9.79	9.83	9.66	9.65	9.63	9.53	9.36	9.50	9.45	9.42	9.40
12C	52638.5	201932.4	10.46	10.56	10.47	#N/A	9.82	9.87	9.88	9.79	9.73	9.62	9.71	9.59	9.60	9.55	9.50	9.53	9.51	9.49	9.49
13A	52126.5	202078.7	10.05	10.07	10.06	9.54	9.45	9.44	9.49	9.41	9.47	9.28	9.26	9.21	9.20	9.20	11.28	9.24	9.24	9.23	9.23
13B	52227.0	202013.8	10.11	10.07	10.06	9.55	9.46	9.45	9.51	9.43	9.51	9.31	9.30	9.23	9.26	11.24	9.27	9.26	9.26	9.26	9.26
BM 1	51782.1	202593.5	13.41	13.47	13.42	12.92	12.84	12.81	12.86	14.05	13.99	12.69	12.65	12.60	12.61	12.41	12.46	12.51	12.48	12.47	12.47
BM 1A	51779.5	202489.3	12.23	12.31	12.25	11.75	11.63	11.64	11.68	14.62	14.58	11.50	11.43	11.44	11.39	11.25	11.21	11.16	11.01	10.90	10.78
BM 2	50834.4	201746.6	17.48	17.50	17.45	16.95	16.92	16.85	16.83	16.79	16.71	16.67	16.63	16.52	16.39	16.40	16.28	11.22	16.00	15.83	15.59
BM 2A	50830.4	201677.9	17.21	17.25	17.19	16.88	16.77	16.86	16.86	16.81	16.75	16.68	16.65	16.58	16.52	16.50	16.38	16.43	16.32	16.25	16.18
BM 4	51783.2	201720.1	#N/A	11.07	#N/A	14.28	14.14	14.14	14.18	14.12	14.05	13.98	13.94	13.88	13.86	13.77	13.72	13.69	13.49	13.28	12.88
BM 4A	51772.3	201609.9	13.13	13.14	13.10	12.89	12.81	12.83	12.86	12.83	12.78	12.79	12.73	12.62	12.64	12.60	12.80	12.57	12.43	12.28	12.00
BM 4B	51849.3	201677.4	14.48	14.47	14.41	13.92	13.80	13.80	13.84	12.46	12.67	13.94	13.89	13.81	13.80	13.77	15.46	13.47	13.23	13.00	12.54
BM 4C	51720.1	201677.7	14.44	14.44	14.40	13.90	13.79	13.81	13.84	12.43	12.36	13.93	13.90	13.78	13.81	13.76	15.50	13.58	13.38	13.17	12.77
BM 5	52819.9	201247.0	8.03	8.09	8.05	7.55	7.46	7.46	7.51	7.44	7.38	7.33	7.31	7.24	7.23	7.16	7.11	6.97	6.68	6.39	5.84
BM 5A	52760.1	201295.0	8.00	8.06	8.01	7.51	7.42	7.44	7.50	7.71	7.66	7.62	7.28	7.23	7.19	7.18	7.42	7.15	6.92	6.69	6.26
BM 5C	53033.6	201166.4	6.01	6.09	6.08	5.60	5.53	5.54	5.58	8.60	8.58	5.49	5.45	5.39	5.42	5.36	5.32	5.21	4.99	4.77	4.35
BM 101A	53228.2	202101.3	7.05	7.00	6.96	6.48	6.36	6.43	6.53	6.47	7.76	6.35	6.36	6.26	6.27	6.34	7.05	6.33	6.33	6.33	6.33
BM 101C	53190.0	202165.8	7.10	7.05	7.00	6.53	6.40	6.44	6.51	6.45	6.73	6.34	6.34	6.26	6.24	6.19	6.64	6.27	6.26	6.26	6.26
BM 102B	53494.3	203008.4	5.66	5.70	5.62	5.14	5.06	5.09	5.13	5.12	5.02	4.98	4.98	4.92	4.89	4.79	4.79	4.90	4.89	4.89	4.89
BM 102C	53569.8	203009.3	6.62	6.67	6.59	6.11	6.06	6.09	6.13	6.11	6.06	6.01	5.98	5.94	5.96	5.85	5.81	5.91	5.91	5.90	5.90
BM 103B	53280.6	203691.1	6.42	6.48	6.42	5.96	5.89	5.92	5.99	5.94	5.90	5.87	5.84	5.80	5.80	5.72	6.51	5.81	5.80	5.80	5.80
BM 103C	53280.3	203766.2	7.01	7.06	6.97	6.52	6.44	6.48	6.56	6.52	6.49	6.42	6.43	6.39	6.37	6.30	6.83	6.39	6.39	6.39	6.39
BM 104A	52689.1	202643.4	10.83	10.83	10.78	10.25	10.17	10.18	10.24	10.16	10.09	10.03	10.03	9.95	9.94	9.84	10.61	9.93	9.92	9.92	9.92
BM 104B	52737.7	202701.7	10.76	10.74	10.69	10.17	#N/A	10.12	10.16	10.10	10.04	9.97	9.97	9.91	9.90	9.82	10.29	9.89	9.88	9.87	9.87
BM 104C	52665.0	202713.8	10.86	10.86	10.82	10.29	10.22	10.22	10.26	10.19	10.13	10.05	10.06	9.99	9.97	9.90	10.37	9.97	9.96	9.95	9.95
BM 105B	52315.2	203338.2	14.09	14.15	14.09	13.62	13.53	13.50	13.57	13.52	13.46	13.40	13.35	13.34	13.31	13.22	13.99	13.29	13.28	13.27	13.27
BM 105C	52302.4	203264.0	13.32	13.40	13.																

Appendix 1 (cont.)

Measured and Projected Elevations at Bryan Mound (feet above sea level)

POINT	NORTH	EAST	DEC 82	AUG 83	JAN 84	MAR 85	NOV 86	SEP 87	DEC 88	JAN 90	FEB 91	JAN 92	DEC 92	APR 94	DEC 94	FEB 97	JAN 99	JAN 99	calculated			
			0	8	13	27	47	57	72	85	97	108	119	135	143	169	192					
BM 111C	54009.5	203680.0	#N/A	10.00	9.90	9.42	9.43	#N/A	#N/A	6.79	6.75	6.59	6.59	6.69	6.67	6.67	6.66	6.34	6.21	6.16	6.14	
BM 112A	50328.0	202330.1	12.04	12.20	12.00	11.51	11.36	11.32	11.30	11.37	11.31	11.14	11.11	11.07	11.03	10.95	10.87	10.96	10.93	10.91	10.90	
BM 113B	50230.0	203690.0	#N/A	8.08	7.98	8.89	11.09	11.08	11.07	11.07												
BM 114A	49980.0	201680.0	#N/A	9.30	9.28	9.16	9.11	8.09	8.03	8.00												
BM 114B	49980.0	201680.0	#N/A	9.26	9.24	9.14	9.09	7.97	7.93	7.92												
BM 115A	50270.0	200840.0	#N/A	11.24	11.21	11.16	11.15	11.05	11.80	9.00												
BM 115B	50270.0	200840.0	#N/A	11.09	11.07	11.01	11.00	10.88	11.36	9.10												
BM 116A	50530.0	200130.0	#N/A	7.31	7.27	7.23	7.21	7.09	7.03	11.02												
BM 116B	50530.0	200130.0	#N/A	7.22	7.19	7.14	7.13	7.00	6.94	10.87												
SMS 1	51715.5	199794.1	9.07	9.07	9.05	8.55	#N/A	8.50	8.49	8.45	8.39	8.32	8.29	8.23	8.24	8.13	8.08	7.04	6.91	6.82	6.72	
SMS 2	51479.7	200042.0	7.70	7.69	7.68	#N/A	6.72			6.95	6.81	6.72	6.61									
SMS 3	50652.4	200779.9	11.94	11.99	#N/A	10.78			8.15	8.11	8.08	8.08										
SMS 4	50652.9	201192.4	12.50	12.55	12.50	#N/A	12.02															
SMS 5	50677.6	201604.9	16.35	16.38	16.33	15.82	#N/A	15.72	15.70	15.65	15.59	15.53	15.48	15.42	15.40	na	na	destroyed				
SMS 6	51179.0	201604.5	17.01	17.05	17.00	16.49	#N/A	16.37	16.39	16.31	16.25	16.18	16.13	16.06	16.05	na	na	destroyed				
SMS 7	51178.2	201869.2	15.95	#N/A			15.39	15.37	15.36	15.35												
SMS 9	51660.3	202078.8	12.11	12.14	12.09	11.59	#N/A	11.47	11.51	11.44	11.37	11.30	11.28	11.22	11.20	11.11	11.05	16.02	15.98	15.97	15.96	
SMS 10	51689.7	202589.5	12.47	12.53	12.48	11.79	#N/A	11.86	11.89	11.84	11.78	11.71	#N/A	11.63	11.62	11.53	11.47					
SMS 11	51899.3	202589.5	9.33	#N/A	9.26	#N/A	#N/A	8.69	#N/A	#N/A	8.55	8.49	8.46	8.40	8.39	8.31	destroyed					
SMS 12	51859.9	202278.0	9.67	9.70	9.66	9.15	#N/A	9.04	9.08	9.01	8.95	8.88	8.87	8.80	8.79	8.71	8.65	8.71	8.66	8.65	8.64	
SMS 13	51781.6	201849.1	11.62	11.65	11.62	11.11	11.00	11.00	11.03	10.96	10.90	10.84	10.80	10.74	10.73	10.64	10.58	10.65	10.62	10.60	10.59	
SMS 14	51693.9	201587.2	12.67	12.68	12.65	12.14	#N/A	11.99	12.02	#N/A	11.89	11.84	11.77	11.73	11.70	11.61	11.55	11.61	11.56	11.54	11.52	
SMS 15	51711.7	201490.2	11.78	11.77	11.75	#N/A	na	nf														
SMS 16	52221.1	201705.5	11.06	11.13	11.06	#N/A		5.73														
SMS 17	52745.2	201499.9	5.92	5.99	5.96	#N/A																
SMS 18	53100.2	201250.0	6.44	6.51	6.45	5.94	5.86	5.88	5.92	5.87	5.82	6.60					5.81	5.81	5.81	5.81		
SMS 19	52659.5	201000.2	7.03	7.09	7.04	6.51	6.44	6.46	6.50	6.44	6.38	6.29	6.30	6.23	6.24	6.15	6.76	6.20	6.20	6.20	6.22	
SMS 20	52577.5	201249.8	9.32	9.41	9.35	8.83	8.75	8.76	8.80	8.73	8.67	8.61	8.59	8.51	8.51	8.43	10.00	8.48	8.47	8.46	8.46	
SMS 21	51984.4	201249.8	10.85	10.85	10.83	#N/A	9.95	9.88	9.80	9.80	9.76	9.66	9.61									
SMS 22	51982.8	200998.8	8.16	8.16	8.14	6.73	#N/A	7.27														
SMS 24	51499.9	200559.3	15.53	15.53	15.51	14.99	14.88	14.89	14.88	#N/A	#N/A	14.94	14.86			destroyed	14.83	14.83	14.83	14.83		
SMS 25	51983.4	200559.8	9.37	9.38	9.35	8.86	8.75	8.78	8.79	8.74	8.68	8.58	8.58	8.52	8.50	8.40	8.36	8.43	8.40	8.39	8.38	
SMS 27	50389.5	202666.8	14.23	14.27	14.06	#N/A	13.40	13.45	13.44	13.39	13.33	13.27	13.22	13.17	13.16	13.08	13.01	13.09	13.06	13.05	13.04	
SMS 28	51327.7	203717.1	8.36	8.42	8.37	7.84	7.73	7.75	7.80	7.72	7.66	7.60	7.55	7.52	7.51	7.43	7.37	7.46	7.44	7.43	7.42	
SMS 29	52029.8	203131.5	10.92	10.98	10.94	10.43	10.33	10.30	10.36	10.30	10.24	10.18	10.15	10.09	10.08	9.99	9.95	10.02	9.99	9.98	9.98	
SMS 30	53564.9	203486.1	1.86	1.92	1.86	1.36	1.33	1.35	1.42	1.38	1.33	1.29	1.29	1.24	1.25	1.19	1.17	1.24	1.24	1.24	1.24	
SMS 31	52851.2	202413.6	6.84	6.88	6.83	6.32	6.24	6.23	6.30	6.23	6.17	6.11	6.11	6.04	6.03	5.95	5.90	5.97	5.96	5.96		

Appendix 2

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	EAST	AUG 83		JAN 84		MAR 85		NOV 86		SEP 87		DEC 88		JAN 90	
			Time, months	8	13	change	rate	change								
6A	51232.3	200524.7	0.000	0.000	-0.010	-0.024	-0.520	-0.446	-0.110	-0.066	0.000	0.000	0.002	0.002	-0.072	-0.067
6C	51236.6	200498.9	-0.130	-0.195	-0.110	-0.264	-0.490	-0.420	-0.120	-0.072	0.000	0.000	0.000	0.000	-0.077	-0.071
7A	51742.9	201279.6	-0.010	-0.015	-0.030	-0.072	-0.490	-0.420	-0.090	-0.054	0.020	0.024	-0.020	-0.016	-0.086	-0.080
7B	51861.5	201152.9	0.010	0.015	-0.040	-0.096	-0.500	-0.429	-0.090	-0.054	0.020	0.024	0.020	0.016	-0.095	-0.088
7C	51833.9	201374.7	#N/A	#N/A	-0.040	-0.096	-0.500	-0.429	-0.090	-0.054	0.010	0.012	0.020	0.016	-0.097	-0.089
7D	51962.6	201290.8	0.030	0.045	-0.060	-0.144	-0.490	-0.420	-0.030	-0.018	-0.020	-0.024	0.010	0.008	-0.092	-0.085
8A	51746.0	200835.2	0.020	0.030	-0.030	-0.072	-0.500	-0.429	-0.110	-0.066	0.030	0.036	0.030	0.024	-0.072	-0.067
8B	51859.8	200708.8	-0.010	-0.015	-0.030	-0.072	-0.500	-0.429	0.020	0.012	0.000	0.000	0.040	0.032	-0.053	-0.049
8C	51831.8	200930.4	0.010	0.015	-0.040	-0.096	-0.490	-0.420	-0.110	-0.066	0.010	0.012	0.060	0.048	-0.085	-0.079
8D	51965.0	200834.2	0.030	0.045	-0.030	-0.072	-0.490	-0.420	-0.110	-0.066	0.010	0.012	0.050	0.040	-0.072	-0.066
9A	51742.8	200389.9	0.010	0.015	-0.020	-0.048	-0.520	-0.446	-0.100	-0.060	0.050	0.060	0.000	0.000	-0.083	-0.077
9B	51859.7	200264.6	-0.020	-0.030	-0.030	-0.072	-0.500	-0.429	-0.010	-0.006	0.050	0.060	-0.220	-0.176	0.147	0.135
9C	51842.7	200487.8	-0.010	-0.015	-0.020	-0.048	-0.510	-0.437	-0.100	-0.060	0.030	0.036	0.020	0.016	-0.081	-0.075
9D	51965.2	200384.3	0.020	0.030	-0.020	-0.048	-0.500	-0.429	-0.120	-0.072	0.050	0.060	0.010	0.008	-0.056	-0.052
10A	51743.0	199947.3	-0.010	-0.015	-0.030	-0.072	-0.480	-0.411	-0.090	-0.054	0.030	0.036	-0.010	-0.008	-0.071	-0.066
10B	51859.6	199821.1	0.000	0.000	-0.030	-0.072	-0.400	-0.343	-0.090	-0.054	0.060	0.072	-0.030	-0.024	-0.046	-0.043
10C	51842.6	200044.2	-0.030	-0.045	-0.030	-0.072	-0.490	-0.420	-0.100	-0.060	0.050	0.060	-0.010	-0.008	-0.070	-0.065
10D	51965.8	199939.5	0.020	0.030	-0.040	-0.096	-0.490	-0.420	-0.110	-0.066	0.020	0.024	0.010	0.008	-0.055	-0.051
11A	52237.5	201083.2	-0.070	-0.105	0.080	0.192	-0.510	-0.437	-0.050	-0.030	0.000	0.000	0.010	0.008	-0.022	-0.020
11B	52238.7	200724.1	-0.060	-0.090	0.070	0.168	-0.490	-0.420	-0.040	-0.024	-0.010	-0.012	0.020	0.016	-0.028	-0.026
11C	52500.1	200723.0	-0.070	-0.105	0.080	0.192	-0.500	-0.429	-0.070	-0.042	0.020	0.024	0.020	0.016	-0.012	-0.011
11D	52499.8	201088.1	-0.080	-0.120	0.080	0.192	-0.510	-0.437	-0.060	-0.036	-0.010	-0.012	0.010	0.008	-0.011	-0.010
12B	52541.0	201932.5	0.040	0.060	-0.030	-0.072	-0.540	-0.463	-0.100	-0.060	#N/A	#N/A	#N/A	#N/A	-0.050	-0.046
12C	52638.5	201932.4	0.100	0.150	-0.090	-0.216	#N/A	#N/A	#N/A	#N/A	0.050	0.060	0.010	0.008	-0.092	-0.085
13A	52126.5	202078.7	0.020	0.030	-0.010	-0.024	-0.520	-0.446	-0.090	-0.054	-0.010	-0.012	0.050	0.040	-0.077	-0.071
13B	52227.0	202013.8	-0.040	-0.060	-0.010	-0.024	-0.510	-0.437	-0.090	-0.054	-0.010	-0.012	0.060	0.048	-0.077	-0.071
BM 1	51782.1	202595.3	0.060	0.090	-0.050	-0.120	-0.500	-0.429	-0.080	-0.048	-0.030	-0.036	0.050	0.040	1.192	1.100
BM 1A	51779.5	202489.3	0.080	0.120	-0.060	-0.144	-0.500	-0.429	-0.120	-0.072	0.010	0.012	0.040	0.032	2.943	2.717
BM 2	50834.4	201746.6	0.020	0.030	-0.050	-0.120	-0.500	-0.429	-0.030	-0.018	-0.070	-0.084	-0.020	-0.016	-0.045	-0.042
BM 2A	50830.4	201677.9	0.040	0.060	-0.060	-0.144	-0.310	-0.266	-0.110	-0.066	0.090	0.108	0.000	0.000	-0.048	-0.044
BM 4	51783.2	201720.1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-0.140	-0.084	0.000	0.000	0.040	0.032	-0.063	-0.058
BM 4A	51772.3	201609.9	0.010	0.015	-0.040	-0.096	-0.210	-0.180	-0.080	-0.048	0.020	0.024	0.030	0.024	-0.030	-0.028
BM 4B	51849.3	201677.4	-0.010	-0.015	-0.060	-0.144	-0.490	-0.420	-0.120	-0.072	0.000	0.000	0.040	0.032	-1.385	-1.278
BM 4C	51720.1	201677.7	0.000	0.000	-0.040	-0.096	-0.500	-0.429	-0.110	-0.066	0.020	0.024	0.030	0.024	-1.406	-1.298
BM 5	52819.9	201247.0	0.060	0.090	-0.040	-0.096	-0.500	-0.429	-0.090	-0.054	0.000	0.000	0.050	0.040	-0.065	-0.060
BM 5A	52760.1	201295.0	0.060	0.090	-0.050	-0.120	-0.500	-0.429	-0.089	-0.053	0.019	0.023	0.060	0.048	0.215	0.198
BM 5C	53033.6	201166.4	0.080	0.120	-0.010	-0.024	-0.480	-0.411	-0.070	-0.042	0.010	0.012	0.040	0.032	3.020	2.788

Appendix 2 (cont.)

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	AUG 83		JAN 84		MAR 85		NOV 86		SEP 87		DEC 88		JAN 90		
		Time, months	8	13	change	rate										
BM 102C	53569.8	203009.3	0.050	0.075	-0.080	-0.192	-0.480	-0.411	-0.050	-0.030	0.030	0.036	0.040	0.032	-0.024	-0.022
BM 103B	53280.6	203691.1	-0.040	-0.060	-0.060	-0.144	-0.460	-0.394	-0.010	-0.006	0.010	0.012	0.060	0.048	0.005	0.005
BM 103C	53280.3	203766.2	#N/A	#N/A	-0.100	-0.240	-0.480	-0.411	0.010	0.006	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
BM 104A	52689.1	202643.4	0.060	0.090	-0.060	-0.144	-0.460	-0.394	-0.070	-0.042	0.030	0.036	0.070	0.056	-0.045	-0.042
BM 104B	52737.7	202701.7	0.050	0.075	-0.090	-0.216	-0.450	-0.386	-0.080	-0.048	0.040	0.048	0.080	0.064	-0.042	-0.039
BM 104C	52665.0	202713.8	0.000	0.000	-0.050	-0.120	-0.530	-0.454	-0.080	-0.048	0.010	0.012	0.060	0.048	-0.082	-0.075
BM 105B	52315.2	203338.2	-0.020	-0.030	-0.050	-0.120	-0.520	-0.446	#N/A	#N/A	#N/A	0.040	0.032	-0.059	-0.055	-0.055
BM 105C	52302.4	203264.0	0.000	0.000	-0.040	-0.096	-0.530	-0.454	-0.070	-0.042	0.000	0.000	0.040	0.032	-0.069	-0.063
BM 106A	50889.2	203784.5	0.060	0.090	-0.060	-0.144	-0.470	-0.403	-0.090	-0.054	-0.030	-0.036	0.070	0.056	-0.054	-0.050
BM 106B	50954.6	203747.3	0.080	0.120	-0.080	-0.192	-0.490	-0.420	-0.080	-0.048	-0.040	-0.048	0.090	0.072	-0.064	-0.059
BM 106C	50955.1	203821.4	-0.030	-0.045	-0.060	-0.144	-0.510	-0.437	-0.100	-0.060	0.030	0.036	0.030	0.024	-0.087	-0.080
BM 107A	51363.3	203111.5	0.060	0.090	-0.080	-0.192	-0.560	-0.480	-0.150	-0.090	#N/A	#N/A	#N/A	#N/A	-0.082	-0.076
BM 107B	51298.4	203148.8	0.010	0.015	-0.070	-0.168	-0.520	-0.446	-0.230	-0.138	0.040	0.048	0.030	0.024	-0.085	-0.079
BM 107C	51298.4	203073.8	0.020	0.030	-0.070	-0.168	#N/A	#N/A	#N/A	0.030	0.036	0.050	0.040	-0.090	-0.083	
BM 108A	51698.4	203764.8	0.000	0.000	-0.040	-0.096	-0.520	-0.446	-0.120	-0.072	0.050	0.060	0.030	0.024	-0.094	-0.087
BM 108B	51762.6	203727.5	-0.200	-0.300	-0.150	-0.360	-0.520	-0.446	-0.130	-0.078	0.050	0.060	0.030	0.024	-0.093	-0.086
BM 108C	51761.2	203801.4	0.060	0.090	-0.060	-0.144	-0.520	-0.446	-0.100	-0.060	-0.030	-0.036	0.100	0.080	-0.084	-0.077
BM 109A	50599.5	203035.6	0.060	0.090	-0.080	-0.192	-0.510	-0.437	-0.070	-0.042	-0.020	-0.024	0.080	0.064	-0.069	-0.064
BM 109B	50534.5	202998.2	0.000	0.000	-0.050	-0.120	-0.730	-0.626	0.130	0.078	-0.040	-0.048	0.100	0.080	-0.075	-0.069
BM 109C	50600.4	202960.7	0.040	0.060	-0.030	-0.072	-0.440	-0.377	-0.210	-0.126	-0.010	-0.012	0.000	0.000	-0.062	-0.057
BM 110A	51030.3	202496.3	0.040	0.060	-0.030	-0.072	-0.550	-0.471	-0.100	-0.060	0.030	0.036	0.010	0.008	-0.067	-0.062
BM 110B	50992.4	202430.8	0.050	0.075	-0.040	-0.096	-0.540	-0.463	-0.090	-0.054	0.020	0.024	0.010	0.008	-0.056	-0.052
BM 110C	51067.8	202430.4	0.040	0.060	-0.060	-0.144	-0.530	-0.454	-0.080	-0.048	0.010	0.012	-0.020	-0.016	-0.055	-0.051
BM 111B	54008.1	203757.8	-0.060	-0.090	-0.060	-0.144	-0.520	-0.446	-0.080	-0.048	0.010	0.012	-0.020	-0.016	-0.053	-0.049
BM 111C	54009.5	203680.0	0.030	0.045	-0.050	-0.120	-0.530	-0.454	-0.090	-0.054	0.020	0.024	-0.020	-0.016	-0.053	-0.049
BM 112A	50328.0	202330.1														
BM 112C	50253.8	202318.6														
BM 113A	50230.0	203690.0	0.160	0.240	-0.200	-0.480	-0.490	-0.420	-0.150	-0.090	-0.040	-0.048	-0.020	-0.016	0.071	0.065
BM 113B	50230.0	203690.0	0.050	0.075	-0.190	-0.456	-0.490	-0.420	-0.130	-0.078	0.180	0.216	-0.020	-0.016	-0.160	-0.148
BM 114A	49980.0	201680.0														
BM 114B	49980.0	201680.0														
BM 115A	50270.0	200840.0														
BM 115B	50270.0	200840.0														
BM 116A	50530.0	200130.0														
BM 116B	50530.0	200130.0														
SMS 1	51715.5	199794.1														
SMS 2	51479.7	200042.0														
SMS 3	50652.4	200779.9	0.000	0.000	-0.020	-0.048	-0.500	-0.429	#N/A	#N/A	#N/A	#N/A	-0.010	-0.008	-0.043	-0.040
SMS 4	50652.9	201192.4	-0.010	-0.015	-0.010	-0.024	#N/A									

Appendix 2 (cont.)

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	EAST	AUG 83		JAN 84		MAR 85		NOV 86		SEP 87		DEC 88		JAN 90		
			Time, months	8	change	rate	change										
SMS 5	50677.6	201604.9	0.050	0.075	#N/A												
SMS 6	51179.0	201604.5	0.050	0.075	-0.050	-0.120	#N/A										
SMS 7	51178.2	201869.2	0.030	0.045	-0.050	-0.120	-0.510	-0.437	#N/A	#N/A	#N/A	#N/A	-0.020	-0.016	-0.052	-0.048	
SMS 9	51660.3	202078.8	0.040	0.060	-0.050	-0.120	-0.510	-0.437	#N/A	#N/A	#N/A	#N/A	0.020	0.016	-0.076	-0.070	
SMS 10	51689.7	202589.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
SMS 11	51899.3	202589.5	0.030	0.045	-0.050	-0.120	-0.500	-0.429	#N/A	#N/A	#N/A	#N/A	0.040	0.032	-0.071	-0.066	
SMS 12	51859.9	202278.0	0.060	0.090	-0.050	-0.120	-0.690	-0.591	#N/A	#N/A	#N/A	#N/A	0.030	0.024	-0.052	-0.048	
SMS 13	51781.6	201849.1	0.030	0.045	-0.030	-0.072	-0.510	-0.437	-0.110	-0.066	0.000	0.000	0.030	0.024	-0.065	-0.060	
SMS 14	51693.9	201587.2	0.010	0.015	-0.030	-0.072	-0.510	-0.437	#N/A	#N/A	#N/A	#N/A	0.030	0.024	#N/A	#N/A	
SMS 15	51711.7	201490.2	-0.010	-0.015	-0.020	-0.048	#N/A										
SMS 16	52221.1	201705.5	0.070	0.105	-0.070	-0.168	#N/A										
SMS 17	52745.2	201499.9	0.070	0.105	-0.030	-0.072	#N/A										
SMS 18	53100.2	201250.0	0.070	0.105	-0.060	-0.144	-0.510	-0.437	-0.080	-0.048	0.020	0.024	0.040	0.032	-0.046	-0.042	
SMS 19	52659.5	201000.2	0.060	0.090	-0.050	-0.120	-0.530	-0.454	-0.070	-0.042	0.020	0.024	0.040	0.032	-0.055	-0.051	
SMS 20	52577.5	201249.8	0.090	0.135	-0.060	-0.144	-0.520	-0.446	-0.080	-0.048	0.010	0.012	0.040	0.032	-0.070	-0.064	
SMS 21	51984.4	201249.8	0.000	0.000	-0.020	-0.048	#N/A										
SMS 22	51982.8	200998.8	0.000	0.000	-0.020	-0.048	-1.410	-1.209	#N/A								
SMS 24	51499.9	200559.3	0.000	0.000	-0.020	-0.048	-0.520	-0.446	-0.110	-0.066	0.010	0.012	-0.010	-0.008	#N/A	#N/A	
SMS 25	51983.4	200559.8	0.010	0.015	-0.030	-0.072	-0.490	-0.420	-0.110	-0.066	0.030	0.036	0.010	0.008	-0.048	-0.044	
SMS 27	50389.5	202666.8	0.040	0.060	-0.210	-0.504	#N/A	#N/A	#N/A	#N/A	0.050	0.060	-0.010	-0.008	-0.055	-0.051	
SMS 28	51327.7	203717.1	0.060	0.090	-0.050	-0.120	-0.530	-0.454	-0.110	-0.066	0.020	0.024	0.050	0.040	-0.080	-0.073	
SMS 29	52029.8	203131.5	0.060	0.090	-0.040	-0.096	-0.510	-0.437	-0.100	-0.060	-0.030	-0.036	0.060	0.048	-0.063	-0.059	
SMS 30	53564.9	203486.1	0.060	0.090	-0.060	-0.144	-0.500	-0.429	-0.030	-0.018	0.020	0.024	0.070	0.056	-0.045	-0.041	
SMS 31	52851.2	202413.6	0.040	0.060	0.005	0.011	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	

Appendix 2 (cont.)

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	FEB 91		JAN 92		DEC 92		APR 94		DEC 94		FEB 97		JAN 99		
		Time, months	EAST	97	change	rate										
6A	51232.3	200524.7	-0.074	-0.074	-0.242	-0.264	-0.066	-0.072	-0.017	-0.013	0.102	0.153	-0.017	-0.009	0.277	-0.145
6C	51236.6	200498.9	-0.071	-0.071	-0.240	-0.262	-0.004	-0.004	-0.106	-0.080	0.161	0.242	-0.041	-0.021	0.313	-0.163
7A	51742.9	201279.6	-0.062	-0.062	-0.071	-0.077	-0.054	-0.059	-0.029	-0.022	0.000	0.000	-0.090	-0.047	0.084	-0.044
7B	51861.5	201152.9	-0.065	-0.065	-0.092	-0.100	-0.036	-0.039	-0.031	-0.023	-0.014	-0.021	-0.115	-0.060	0.159	-0.083
7C	51833.9	201374.7	-0.064	-0.064	-0.083	-0.090	-0.053	-0.058	-0.015	-0.011	-0.026	-0.039	-0.060	-0.031	0.099	-0.052
7D	51962.6	201290.8	-0.064	-0.064	-0.080	-0.088	-0.056	-0.061	-0.017	-0.013	-0.029	-0.043	-0.071	-0.037	0.091	-0.047
8A	51746.0	200835.2	-0.084	-0.084	-0.094	-0.103	-0.019	-0.021	-0.048	-0.036	-0.011	-0.016	-0.082	-0.043	0.091	-0.047
8B	51859.8	200708.8	-0.087	-0.087	-0.083	-0.091	-0.032	-0.035	-0.043	-0.032	-0.012	-0.018	-0.082	-0.043	0.067	-0.035
8C	51831.8	200930.4	-0.085	-0.085	-0.090	-0.098	-0.029	-0.032	-0.038	-0.029	-0.020	-0.030	-0.069	-0.036	0.077	-0.040
8D	51965.0	200834.2	-0.082	-0.082	-0.076	-0.083	-0.029	-0.032	-0.049	-0.037	-0.024	-0.036	-0.045	-0.023	0.092	-0.048
9A	51742.8	200389.9	-0.071	-0.071	-0.054	-0.059	-0.069	-0.075	-0.046	-0.034	-0.008	-0.012	-0.143	-0.075	0.029	-0.015
9B	51859.7	200264.6	-0.062	-0.062	-0.069	-0.076	-0.046	-0.050	-0.053	-0.040	-0.018	-0.027	-0.123	-0.064	0.141	-0.074
9C	51842.7	200487.8	-0.066	-0.066	-0.053	-0.058	-0.075	-0.082	-0.029	-0.022	-0.034	-0.051	-0.112	-0.058	0.032	-0.017
9D	51965.2	200384.3	-0.072	-0.072	-0.061	-0.066	-0.060	-0.065	-0.033	-0.025	-0.039	-0.058	-0.107	-0.056	0.029	-0.015
10A	51743.0	199947.3	-0.061	-0.061	-0.089	-0.097	-0.030	-0.033	-0.029	-0.022	0.000	0.000	-0.142	-0.074	0.057	-0.030
10B	51859.6	199821.1	-0.059	-0.059	-0.081	-0.089	-0.023	-0.025	-0.040	-0.030	0.016	0.024	-0.137	-0.071	0.153	-0.080
10C	51842.6	200044.2	-0.065	-0.065	-0.090	-0.098	-0.030	-0.033	-0.046	-0.034	0.011	0.017	-0.137	-0.071	0.068	-0.035
10D	51965.8	199939.5	-0.057	-0.057	-0.064	-0.070	-0.048	-0.052	-0.050	-0.038	0.003	0.005	-0.118	-0.062	0.053	-0.028
11A	52237.5	201083.2	-0.059	-0.059	-0.103	-0.113	0.036	0.039	-0.071	-0.053	-0.031	-0.046	-0.081	-0.042	0.055	-0.029
11B	52238.7	200724.1	-0.053	-0.053	-0.086	-0.094	0.016	0.017	-0.039	-0.029	-0.042	-0.063	-0.070	-0.037	0.045	-0.023
11C	52500.1	200723.0	-0.048	-0.048	-0.093	-0.102	0.019	0.021	-0.067	-0.050	-0.007	-0.010	-0.078	-0.041	0.034	-0.018
11D	52499.8	201088.1	-0.062	-0.062	-0.097	-0.106	0.021	0.023	-0.065	-0.049	-0.073	-0.110	-0.033	-0.017	0.234	-0.122
12B	52541.0	201932.5	-0.058	-0.058	0.033	0.036	-0.165	-0.180	-0.010	-0.007	-0.018	-0.027	-0.098	-0.051	0.178	-0.093
12C	52638.5	201932.4	-0.056	-0.056	-0.112	-0.122	0.088	0.096	-0.118	-0.089	0.012	0.018	-0.049	-0.026	0.055	-0.029
13A	52126.5	202078.7	0.055	0.055	-0.186	-0.203	-0.019	-0.021	-0.057	-0.043	-0.010	-0.015	0.085	0.044		
13B	52227.0	202013.8	0.072	0.072	-0.197	-0.215	-0.012	-0.013	-0.072	-0.054	0.006	0.009	0.034	0.018		
BM 1	51782.1	202595.3	-0.057	-0.057	-1.307	-1.426	-0.043	-0.047	-0.041	-0.031	0.009	0.014	-0.203	-0.106	-0.051	0.027
BM 1A	51779.5	202489.3	-0.041	-0.041	-3.084	-3.364	-0.069	-0.075	0.015	0.011	-0.059	-0.089	-0.137	-0.071	0.035	-0.018
BM 2	50834.4	201746.6	-0.079	-0.079	-0.037	-0.040	-0.040	-0.044	-0.106	-0.080	-0.132	-0.198	0.005	0.003	0.118	-0.062
BM 2A	50830.4	201677.9	-0.062	-0.062	-0.066	-0.072	-0.034	-0.037	-0.066	-0.049	-0.067	-0.101	-0.016	-0.008	0.125	-0.065
BM 4	51783.2	201720.1	-0.065	-0.065	-0.071	-0.078	-0.039	-0.043	-0.062	-0.046	-0.018	-0.027	-0.093	-0.049	0.054	-0.028
BM 4A	51772.3	201609.9	-0.051	-0.051	0.010	0.011	-0.062	-0.067	-0.104	-0.078	0.015	0.023	-0.043	-0.022		
BM 4B	51849.3	201677.4	0.218	0.218	1.266	1.381	-0.054	-0.059	-0.077	-0.058	-0.004	-0.006	-0.032	-0.017		
BM 4C	51720.1	201677.7	-0.076	-0.076	1.567	1.710	-0.028	-0.031	-0.118	-0.089	0.031	0.047	-0.052	-0.027		
BM 5	52819.9	201247.0	-0.067	-0.067	-0.044	-0.048	-0.021	-0.023	-0.074	-0.055	-0.008	-0.012	-0.074	-0.039	0.049	-0.026
BM 5A	52760.1	201295.0	-0.057	-0.057	-0.035	-0.038	-0.338	-0.369	-0.054	-0.040	-0.066	-0.007	-0.004	-0.238	0.124	

Appendix 2 (cont.)

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	EAST	FEB 91		JAN 92		DEC 92		APR 94		DEC 94		FEB 97		JAN 99		
			Time, months		97	108	rate	change	rate								
BM 5C	53033.6	201166.4	-0.016	-0.016	-3.095	-3.377	-0.039	-0.043	-0.064	-0.048	0.034	0.051	-0.056	-0.029	0.040	-0.021	
BM 101A	53228.2	202101.3	1.297	1.297	-1.415	-1.544	0.008	0.009	-0.092	-0.069	0.011	0.017	0.063	0.033			
BM 101C	53190.0	202165.8	0.276	0.276	-0.390	-0.426	0.005	0.005	-0.080	-0.060	-0.023	-0.034	-0.049	-0.026	0.096	-0.050	
BM 102B	53494.3	203008.4	-0.095	-0.095	-0.046	-0.050	-0.002	-0.002	-0.074	-0.055	0.022	0.033	-0.037	-0.019	0.037	-0.019	
BM 102C	53569.8	203009.3	-0.046	-0.046	-0.046	-0.050	-0.033	-0.036	-0.038	-0.029	0.016	0.024	-0.114	-0.059			
BM 103B	53280.6	203691.1	-0.053	-0.053	-0.728	-0.794	-0.034	-0.037	-0.043	-0.032	0.003	0.005	-0.080	-0.042			
BM 103C	53280.3	203766.2	-0.039	-0.039	-0.333	-0.363	0.006	0.007	-0.038	-0.029	-0.018	-0.027	-0.067	-0.035			
BM 104A	52689.1	202643.4	-0.044	-0.044	4.126	4.501	0.007	0.008	-0.082	-0.061	-0.010	-0.015	-0.100	-0.052			
BM 104B	52737.7	202701.7	-0.032	-0.032	3.481	3.797	0.007	0.008	-0.065	-0.049	-0.012	-0.018	-0.076	-0.040			
BM 104C	52665.0	202713.8	-0.064	-0.064	-0.045	-0.049	0.006	0.007	-0.069	-0.052	-0.013	-0.019	-0.073	-0.038			
BM 105B	52315.2	203338.2	-0.059	-0.059	3.360	3.666	-0.049	-0.053	-0.016	-0.012	-0.028	-0.042	-0.090	-0.047			
BM 105C	52302.4	203264.0	-0.063	-0.063	2.494	2.721	-0.017	-0.019	-0.051	-0.038	-0.020	-0.030	-0.088	-0.046			
BM 106A	50889.2	203784.5	-0.061	-0.061	2.119	2.312	-0.021	-0.023	-0.068	-0.051	-0.010	-0.015	-0.073	-0.038			
BM 106B	50954.6	203747.3	-0.055	-0.055	3.076	3.356	-0.035	-0.038	-0.071	-0.053	-0.008	-0.012	-0.074	-0.039			
BM 106C	50955.1	203821.4	-0.064	-0.064	0.703	0.767	-0.020	-0.022	-0.072	-0.054	-0.007	-0.011	-0.070	-0.037	0.059	-0.031	
BM 107A	51363.3	203111.5	-0.061	-0.061	-0.830	-0.905	-0.014	-0.015	-0.063	-0.047	-0.025	-0.038	-0.086	-0.045	0.058	-0.030	
BM 107B	51298.4	203148.8	-0.064	-0.064	-1.318	-1.438	-0.013	-0.014	-0.066	-0.050	-0.016	-0.024	-0.090	-0.047	0.044	-0.023	
BM 107C	51298.4	203073.8	-0.073	-0.073	0.254	0.277	-0.026	-0.028	-0.054	-0.041	-0.016	-0.024	-0.092	-0.048			
BM 108A	51698.4	203764.8	-0.076	-0.076	0.575	0.628	-0.028	-0.031	-0.055	-0.041	-0.008	-0.012	-0.083	-0.043			
BM 108B	51762.6	203727.5	-0.067	-0.067	0.465	0.507	-0.029	-0.032	-0.049	-0.037	-0.011	-0.016	-0.078	-0.041	0.046	-0.024	
BM 108C	51761.2	203801.4	-0.068	-0.068	-0.004	-0.004	-0.039	-0.043	-0.042	-0.031	0.012	0.018	-0.087	-0.045			
BM 109A	50599.5	203035.6	-0.067	-0.067	-0.377	-0.412	-0.049	-0.053	-0.070	-0.053	-0.004	-0.006	-0.033	-0.017			
BM 109B	50534.5	202998.2	-0.073	-0.073	-0.207	-0.226	-0.027	-0.029	-0.068	-0.051	-0.021	-0.032	-0.075	-0.039			
BM 109C	50600.4	202960.7	-0.053	-0.053	0.050	0.054	-0.024	-0.026	-0.062	-0.046	-0.014	-0.021	-0.070	-0.037	0.054	-0.028	
BM 110A	51030.3	202496.3	-0.059	-0.059	-0.059	-0.064	-0.031	-0.034	-0.088	-0.066	0.001	0.002	-0.105	-0.055	0.064	-0.033	
BM 110B	50992.4	202430.8	-0.061	-0.061	-0.194	-0.212	-0.043	-0.047	-0.093	-0.070	0.002	0.003	-0.098	-0.051	0.053	-0.028	
BM 110C	51067.8	202430.4	-0.067	-0.067	-0.233	-0.255	-0.025	-0.027	-0.090	-0.067	-0.004	-0.006	-0.129	-0.067	0.036	-0.019	
BM 111B	54008.1	203757.8	-0.066	-0.066	-8.840	-9.644	0.018	0.020	-0.167	-0.125	-0.022	-0.033	-0.029	-0.015	0.003	-0.002	
BM 111C	54009.5	203680.0	-0.064	-0.064	-8.978	-9.794	0.008	0.009	0.093	0.070	-0.016	-0.024	-0.005	-0.003	0.082	-0.043	
BM 112A	50328.0	202330.1					-0.028	-0.031	-0.042	-0.031	-0.043	-0.064	-0.077	-0.040	0.084	-0.044	
BM 112C	50253.8	202318.6					-0.036	-0.039	-0.059	-0.044	-0.031	-0.047	-0.062	-0.032			
BM 113A	50230.0	203690.0	-0.065	-0.065	-0.165	-0.180	-0.003	-0.003	-0.080	-0.060	-0.003	-0.005	-0.101	-0.053			
BM 113B	50230.0	203690.0	-0.069	-0.069	0.051	0.055	-0.003	-0.003	-0.078	-0.059	0.003	0.005	-0.105	-0.055	0.057	-0.030	
BM 114A	49980.0	201680.0					-0.040	-0.044	-0.031	-0.023	-0.025	-0.038	-0.114	-0.059	0.054	-0.028	
BM 114B	49980.0	201680.0					-0.035	-0.038	-0.024	-0.018	-0.018	-0.027	-0.099	-0.052			
BM 115A	50270.0	200840.0					-0.025	-0.027	-0.051	-0.038	-0.014	-0.021	-0.095	-0.050			
BM 115B	50270.0	200840.0					-0.020	-0.022	-0.065	-0.049	-0.008	-0.012	-0.124	-0.065	0.058	-0.030	
BM 116A	50530.0	200130.0					-0.034	-0.037	-0.046	-0.035	-0.019	-0.029	-0.120	-0.063	0.058	-0.030	
BM 116B	50530.0	200130.0					-0.034	-0.037	-0.043	-0.032	-0.012	-0.018	-0.129	-0.067	0.044	-0.023	

Appendix 2 (cont.)

Calculated Historical Subsidence Rates at Bryan Mound

Elevation change (ft); Interval rate (ft/yr)

Station	NORTH	EAST	FEB 91		JAN 92		DEC 92		APR 94		DEC 94		FEB 97		JAN 99	
			Time, months	97	change	rate	change	rate								
SMS 1	51715.5	199794.1							-0.022	-0.024	-0.063	-0.047	0.011	0.016	-0.114	-0.059
SMS 2	51479.7	200042.0					#N/A	#N/A	-6.724	-5.043						
SMS 3	50652.4	200779.9	-0.054	-0.054	-0.079	-0.086	#N/A	#N/A	-10.78	-8.084						
SMS 4	50652.9	201192.4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-12.02	-9.012						
SMS 5	50677.6	201604.9	#N/A	#N/A	#N/A	#N/A	-0.053	-0.058	-0.055	-0.041	-0.021	-0.032				
SMS 6	51179.0	201604.5	#N/A	#N/A	#N/A	#N/A	-0.049	-0.053	-0.062	-0.047	-0.012	-0.018				
SMS 7	51178.2	201869.2	-0.059	-0.059	-0.059	-0.064	#N/A	#N/A	#N/A	#N/A						
SMS 9	51660.3	202078.8	-0.068	-0.068	-0.071	-0.078	-0.024	-0.026	-0.065	-0.049	-0.014	-0.021	-0.089	-0.046	0.064	-0.033
SMS 10	51689.7	202589.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-0.012	-0.018	-0.086	-0.045	0.062	-0.032
SMS 11	51899.3	202589.5	-0.064	-0.064	-0.071	-0.077	-0.031	-0.034	-0.054	-0.041	-0.013	-0.019	-0.078	-0.041	destroyed	
SMS 12	51859.9	202278.0	-0.062	-0.062	-0.063	-0.068	-0.016	-0.017	-0.064	0.000	-0.009	-0.014	-0.087	-0.045	0.055	-0.029
SMS 13	51781.6	201849.1	-0.064	-0.064	-0.063	-0.069	-0.040	-0.044	-0.059	0.000	-0.012	-0.018	-0.091	-0.047	0.060	-0.031
SMS 14	51693.9	201587.2	#N/A	#N/A	-0.059	-0.064	-0.063	-0.069	-0.045	0.000	-0.028	-0.042	-0.095	-0.050	0.053	-0.028
SMS 15	51711.7	201490.2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						
SMS 16	52221.1	201705.5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						
SMS 17	52745.2	201499.9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A						
SMS 18	53100.2	201250.0	-0.055	-0.055	0.783	0.854	-6.602	-7.202								
SMS 19	52659.5	201000.2	-0.061	-0.061	-0.094	-0.102	0.014	0.015	-0.072	-0.001	0.005	0.007	-0.087	-0.045		
SMS 20	52577.5	201249.8	-0.063	-0.063	-0.062	-0.067	-0.012	-0.013	-0.080	-0.001	-0.003	-0.005	-0.079	-0.041		
SMS 21	51984.4	201249.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-9.948	-0.074	9.876	14.814	-0.079	-0.041	0.000	0.000
SMS 22	51982.8	200998.8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	-7.265	-0.054						
SMS 24	51499.9	200559.3	#N/A	#N/A	#N/A	#N/A	-0.078	-0.085	-14.86	-0.110						
SMS 25	51983.4	200559.8	-0.063	-0.063	-0.102	-0.112	-0.001	-0.001	-0.056	0.000	-0.022	-0.033	-0.094	-0.049	0.044	-0.023
SMS 27	50389.5	202666.8	-0.058	-0.058	-0.062	-0.068	-0.042	-0.046	-0.052	0.000	-0.009	-0.013	-0.087	-0.045	0.066	-0.034
SMS 28	51327.7	203717.1	-0.057	-0.057	-0.062	-0.068	-0.050	-0.055	-0.028	0.000	-0.011	-0.017	-0.082	-0.043	0.060	-0.031
SMS 29	52029.8	203131.5	-0.057	-0.057	-0.064	-0.070	-0.031	-0.034	-0.055	0.000	-0.007	-0.010	-0.089	-0.046	0.045	-0.023
SMS 30	53564.9	203486.1	-0.041	-0.041	-0.040	-0.043	-0.007	-0.008	-0.049	0.000	0.016	0.024	-0.061	-0.032	0.019	-0.010
SMS 31	52851.2	202413.6	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-0.012	0.000	0.000	0.000	0.050	-0.026	

Appendix 3

Fitting Parameters for Long Term Subsidence Prediction

Station	North	East	Y_0	A_1	t_1
6A	51232.3	200524.7	18.3043	1.38270	85.6538
6C	51236.6	200498.9	18.25248	1.37308	96.26134
7A	51742.9	201279.6	10.29605	1.13452	70.92763
7B	51861.5	201152.9	10.25713	1.20500	84.70372
7C	51833.9	201374.7	10.34275	1.14199	63.11259
7D	51962.6	201290.8	10.2816	1.12563	77.55844
8A	51746.0	200835.2	10.38731	1.10366	72.7061
8B	51859.8	200708.8	10.39924	0.95991	70.63652
8C	51831.8	200930.4	10.42008	1.08866	68.23798
8D	51965.0	200834.2	10.44898	1.05131	68.39536
9A	51742.8	200389.9	8.3304	1.15217	77.86055
9B	51859.7	200264.6	8.31041	1.04685	80.29112
9C	51842.7	200487.8	8.39326	1.11299	71.41891
9D	51965.2	200384.3	8.42099	1.07914	73.25024
10A	51743.0	199947.3	8.21047	1.10611	75.0815
10B	51859.6	199821.1	8.15878	1.05273	101.65255
10C	51842.6	200044.2	8.25987	1.11047	73.01205
10D	51965.8	199939.5	8.22544	1.05677	66.90937
11A	52237.5	201083.2	23.38606	0.90048	63.2027
11B	52238.7	200724.1	23.72398	0.83764	59.23209
11C	52500.1	200723.0	23.26999	0.81296	53.6231
11D	52499.8	201088.1	23.16906	1.04805	86.81545
12B	52541.0	201932.5	9.39547	1.11451	82.55954
12C	52638.5	201932.4	9.48861	1.09314	59.85899
13A	52126.5	202078.7	9.2321	0.90652	42.88993
13B	52227.0	202013.8	9.25859	0.90921	40.91331
BM 1	51782.1	202595.3	12.46814	1.02206	57.90697
BM 1A	51779.5	202489.3	10.64833	1.55112	173.00418
BM 2	50834.4	201746.6	15.20759	2.20922	246.60157
BM 2A	50830.4	201677.9	16.10563	1.10499	156.05109
BM 4	51783.2	201720.1	-43.54544	57.90721	16631.35322
BM 4A	51772.3	201609.9	-44.20079	57.24173	23485.9722
BM 4B	51849.3	201677.4	-43.60683	57.83318	14602.64216
BM 4C	51720.1	201677.7	-43.5969	57.83691	16798.82823
BM 5	52819.9	201247.0	-46.67825	54.57669	11239.23356
BM 5A	52760.1	201295.0	-46.68981	54.55613	14464.16759
BM 5C	53033.6	201166.4	-47.66919	53.57774	14639.29896
BM 101A	53228.2	202101.3	6.32844	0.79429	28.08534
BM 101C	53190.0	202165.8	6.26365	0.89234	36.31978
BM 102B	53494.3	203008.4	4.88932	0.84088	42.52179
BM 102C	53569.8	203009.3	5.90249	0.78030	43.51269
BM 103B	53280.6	203691.1	5.80281	0.70732	35.31201
BM 103C	53280.3	203766.2	6.39253	0.70927	30.49272
BM 104A	52689.1	202643.4	9.91592	0.97382	46.56238
BM 104B	52737.7	202701.7	9.86989	0.93344	47.84346
BM 104C	52665.0	202713.8	9.95105	0.97193	46.80048
Station	North	East	Y_0	A_1	t_1

BM 105B	52315.2	203338.2	13.2722	0.89857	49.75118
BM 105C	52302.4	203264.0	12.51924	0.89633	45.23817
BM 106A	50889.2	203784.5	15.44696	1.02572	48.25811
BM 106B	50954.6	203747.3	15.62296	1.05297	45.71088
BM 106C	50955.1	203821.4	16.20576	1.18503	46.49902
BM 107A	51363.3	203111.5	14.69959	1.17594	72.63138
BM 107B	51298.4	203148.8	14.86091	1.11303	65.89338
BM 107C	51298.4	203073.8	15.0664	1.05876	68.47629
BM 108A	51698.4	203764.8	15.6212	0.96891	47.57446
BM 108B	51762.6	203727.5	15.73754	0.92634	45.84167
BM 108C	51761.2	203801.4	15.69658	0.94907	39.3685
BM 109A	50599.5	203035.6	15.23492	1.23294	5.88792
BM 109B	50534.5	202998.2	15.47083	1.05513	56.09317
BM 109C	50600.4	202960.7	15.46963	1.02103	54.00277
BM 110A	51030.3	202496.3	15.39091	1.15242	68.18019
BM 110B	50992.4	202430.8	15.24365	1.16792	63.07517
BM 110C	51067.8	202430.4	15.201	1.16515	70.3971
BM 111B	54008.1	203757.8	6.55223	0.67175	22.64331
BM 111C	54009.5	203680.0	6.13039	4.77237	61.52311
BM 112A	50328.0	202330.1	10.90215	1.23812	63.11808
BM 112C	50253.8	202318.6	11.0706	0.99591	46.37282
BM 113A	50230.0	203690.0	7.97538	1.48423	75.55727
BM 113B	50230.0	203690.0	7.90795	1.98173	55.14454
BM 114A	49980.0	201680.0	8.80123	1.30762	134.56609
BM 114B	49980.0	201680.0	8.89944	1.18952	107.75781
BM 115A	50270.0	200840.0	10.83579	1.21373	101.0027
BM 115B	50270.0	200840.0	10.79807	2.1015	57.17998
BM 116A	50530.0	200130.0	6.63566	1.39322	153.87929
BM 116B	50530.0	200130.0	6.5188	1.41992	159.87737
SMS 1	51715.5	199794.1	8.07501	1.01147	72.20872
SMS 5	50677.6	201604.9	15.35345	1.07065	57.13655
SMS 6	51179.0	201604.5	15.96068	1.12205	63.82736
SMS 9	51660.3	202078.8	11.03756	1.12218	71.735
SMS 10	51689.7	202589.5	11.51439	1.00997	59.1054
SMS 11	51899.3	202589.5	8.2001	1.17032	76.35781
SMS 12	51859.9	202278.0	8.63241	1.08764	70.76842
SMS 13	51781.6	201849.1	10.59081	1.08212	66.24379
SMS 14	51693.9	201587.2	11.52074	1.19945	72.58873
SMS 18	53100.2	201250.0	5.8097	0.76226	26.15335
SMS 19	52659.5	201000.2	6.19966	0.91566	47.7901
SMS 20	52577.5	201249.8	8.45689	0.95495	54.04314
SMS 21	51984.4	201249.8	9.53683	1.38742	105.03494
SMS 24	51499.9	200559.3	14.8326	0.80836	26.72039
SMS 25	51983.4	200559.8	8.38024	1.03326	64.04165
SMS 27	50389.5	202666.8	13.04237	1.25638	56.82922
SMS 28	51327.7	203717.1	7.42375	1.01563	55.04952
SMS 29	52029.8	203131.5	9.97426	1.01939	60.23647
SMS 30	53564.9	203486.1	1.23873	0.71316	33.87265
SMS 31	52851.2	202413.6	5.96053	0.94417	52.86807

*The fitting parameter x_0 (x_1 at time =0) is equal to zero for all predictions.

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